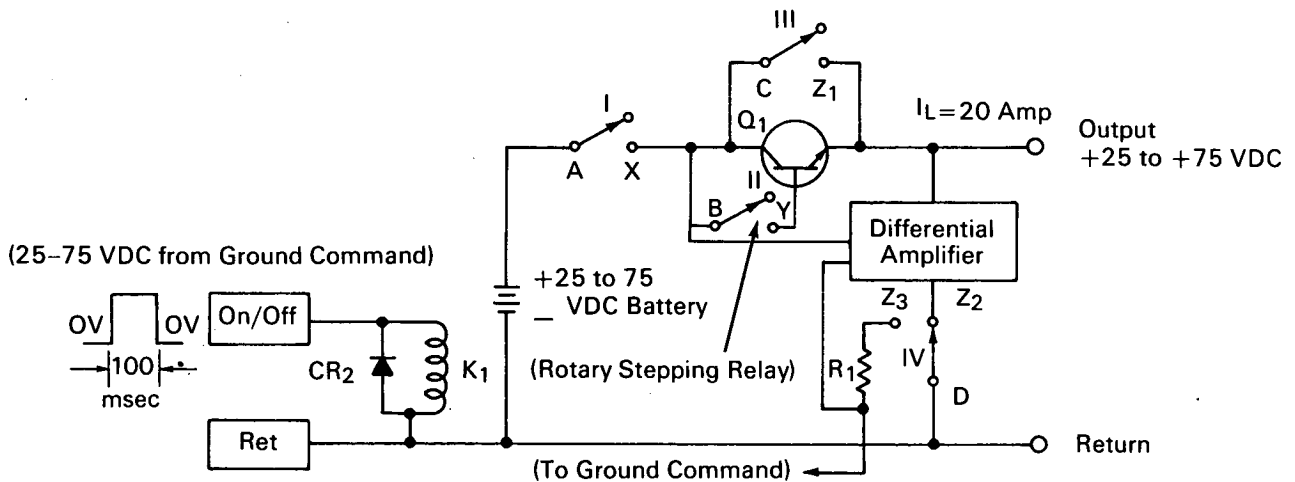


# NASA TECH BRIEF



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## Hybrid Solid State Switch Replaces Motor-Driven Power Switch



Note: All contacts are shown in the off position

### The problem:

To replace existing motor-driven power switches used on spacecraft. Presently available motor driven switches are heavy, large, produce a stray external field, and are costly.

### The solution:

A hybrid solid state switch that uses both a transistor circuit and relay contacts. The transistor circuit handles the turn-on and turn-off transients and allows only 3 volts or less to appear across an associated pair of relay contacts during contact transfer. By limiting the open circuit voltage to this small amount during transfer, unusually high transient currents at reasonable cycle life can be handled by a small relay contact. After transfer, the open circuit voltage may be increased, as this is only limited by the contact insulation.

### How it's done:

A transistor circuit handles the closing and opening transients and limits to 3 volts or less the voltage appearing across an associated pair of relay contacts during contact transfer. The relay contacts are closed for the steady state load and provide a minimum voltage drop.

To eliminate battery current drain, the associated logic circuitry is completely disconnected during the steady state on or off periods. Ground (or remote) hard line commands bring this circuitry into action only during transfer to on or off. A single rotary stepping relay using rolling contacts is employed to accomplish the switching. It is the electrical equivalent of a 4-pole mechanical latching relay. The relay has provisions for make-before-break and make-after-break contact arrangements and is capable of performing certain time dependent logic functions, which are primarily of a switching nature.

(continued overleaf)

To reduce weight, much of the logic circuitry is located at the remote command position. A differential amplifier measures the voltage that appears across the switch contacts that are to handle the full load current. When 3 volts or less appear across these contacts, a signal is sent to the remote logic to step the relay which will close the contacts. On opening, the circuitry maintains a maximum of 3 volts across the load current carrying contacts until the contacts are fully open wherein the voltage may then rise to its full open circuit value.

**Notes:**

1. The hybrid solid state switch has been bread-boarded and satisfactory test results have been obtained at  $-10^{\circ}$ ,  $25^{\circ}$ , and  $75^{\circ}\text{C}$ .

2. This switch could be used for high-current switching at high voltages using small relay contacts where a compact, lightweight, reliable switching device is needed. It could be used, for example, for heavy duty motors where large starting currents are required to drive the pumps of washing machines and oil burners.
3. Inquiries concerning this invention may be directed to:

Technology Utilization Officer  
Jet Propulsion Laboratory  
4800 Oak Grove Drive  
Pasadena, California 91103  
Reference: B67-10165

**Patent status:**

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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(JPL-931)